Routledge
Taylor & Francis Group

Design for Health

ISSN: 2473-5132 (Print) 2473-5140 (Online) Journal homepage: http://www.tandfonline.com/loi/rfdh20

Prototyping an emotionally responsive hospital environment

Reid Douglas, Stephen Reay, Josh Munn & Nick Hayes

To cite this article: Reid Douglas, Stephen Reay, Josh Munn & Nick Hayes (2018): Prototyping an emotionally responsive hospital environment, Design for Health, DOI: 10.1080/24735132.2017.1412689

To link to this article: https://doi.org/10.1080/24735132.2017.1412689

Published online: 02 Jan 2018.

DESIGN FOR HEALTH, 2018
https://doi.org/10.1080/24735132.2017.1412689

Routledge
Taylor & Francis Group

ARTICLE

Prototyping an emotionally responsive hospital environment

Reid Douglas[a,b], Stephen Reay [a,b], Josh Munn[a,b] and Nick Hayes[a,b]

[a]School of Art & Design, AUT University, Auckland, New Zealand; [b]Design for Health and Wellbeing (DHW) Lab, Auckland City Hospital, Auckland, New Zealand

ABSTRACT

This case study presents a project based on a spatial redesign at Auckland City Hospital. The project aimed to improve the public waiting area located outside an intensive care unit – a space where families and friends wait for updates on their loved one's condition. As an environment, the area was characterized by high levels of stress and anxiety, and described by families and staff as 'impersonal', 'unfriendly' and 'uncomfortable'. The project focused on how designers sought to engage users, collected insights about their experiences, developed concepts for improvement and generated buy-in from hospital stakeholders. We explore how making or prototyping as design practice was used to inspire new ways of thinking about the space to respond to its users' emotional needs. Through this, the Design for Health & Wellbeing Lab design team sought to make visible the process and value designers can bring to a hospital environment through prototyping and sharing ideas.

ARTICLE HISTORY
Received 13 July 2017
Accepted 30 November 2017

KEYWORDS
Hospital; spatial design; design for health; prototyping; co-design

Introduction

The Design for Health and Wellbeing (DHW) Lab is a design studio based in Auckland City Hospital, New Zealand as a partnership between Auckland University of Technology (AUT) and Auckland District Health Board (Auckland DHB) (Reay et al. 2017a). The DHW Lab is a mixed discipline design studio that contributes to improving healthcare experiences with patients, families and staff using human-centred design approaches.

This paper reports on a recent spatial design upgrade project. The specific site was located directly outside the surgical wards at Auckland City Hospital. This hospital intensive care unit (ICU) waiting environment is often a place of extreme grief and anxiety. Family groups wait for news of their loved ones who are often undergoing emergency surgery. Currently, there are three 'whānau[1] rooms' designated through the centre of an overbridge connecting two buildings, creating

CONTACT Stephen Reay sreay@aut.ac.nz

a difficult thoroughfare through the waiting space. If the darkened rooms are occupied, other family groups are left to manage by using the remaining seats that line the corridors. These waiting spaces may be considered the cultural and emotional heart of the hospital, and this design-led project focused on improving this general environment (Figure 1).

The following design activity explored how the DHW Lab might contribute to the formation of a concept design – one that went beyond functional requirement-gathering for a spatial refurbishment, to bring form to latent needs in practical yet creative ways. Here, we aim to illustrate the complexity associated with undertaking design-led projects in hospital environments. The DHW Lab embarked on an explorative, iterative journey where prototyping was used to draw together the stories and opinions of unrelated individuals (families, nurses, cleaners, managers, social workers), all of whom had a connection to the waiting space. The Lab responded with critical design artefacts (used to visually articulate user issues or needs) and possible solutions. Through the creation and iterative development of these artefacts, prototyping was considered core to the project's methodological approach. The DHW Lab's role was not considered a 'low cost' architectural resource. Rather, the project agenda was to bring focus to the front-end of the project where opportunities are identified and concepts developed (Sanders and Stappers 2008), by asking users 'what should an appropriate hospital family waiting space be', and using the prototypes and visual experiments to generate buy-in.

Figure 1. Existing whānau area. Left: thoroughfare running through the whanau area. Top-right: one of three family rooms. Bottom-right: entrance space outside lift lobby.

Scarce funding is a symptom of working in the public health sector (Keene et al. 2016). While the project was drawn to the attention of the DHW Lab by senior leadership, such initiatives may be caught in a holding pattern – 'show us what we will get before we invest'. We attempted to counter this with 'invest, and we can show you what you will get'. While there was an expectation that the project should be 'patient and family centred', there was little consensus on what that looked like in the context of a spatial refurbishment project for a public area. Some groups expressed hesitation to invest in improving the standard of public environments due to poor expectations around user behaviour, as anything 'nice' provided for the public would be damaged.

Project scoping

In parallel to the senior leadership request to explore opportunities for the space, a postgraduate design student's practice-led research project was underway. In this study, observational research captured the stories of families waiting in the environment. The research helped to reinforce the need for a more empathic response to the design of the area, particularly with regard to providing opportunities that might enhance connection and interaction between the individuals and family groups present. Following this, an initial workshop generated some concepts to help clarify the project's scope and explore its potential (Figure 2). This brought together four designers with Auckland DHB staff who regularly interacted with whānau who used the waiting space. The workshop explored the assumptions of the group, and by building on anecdotal evidence, highlighted the need for a spatial redesign of the waiting environment. Excitement was generated in terms of what might have been possible if a more comprehensive person-centred design approach was taken. An output from this workshop was later discussed with an Auckland DHB staff member who had a recent experience in the whānau space as a family member, and helped to confirm some of the findings. Initial considerations included:

(1) The existing space was 'cold', clinical and impersonal, and failed to effectively accommodate those families and friends seeking comfort, privacy and refuge.
(2) Due to the large, fixed nature of existing whānau rooms, the space was not suited to smaller families. Large rooms occupied by one or two individuals prevented big groups from feeling welcome.
(3) Solid visual barriers separated families both physically and emotionally from their loved ones being treated in the ICU.
(4) The placement of the whānau rooms made it difficult for staff and other visitors to easily navigate through the space. Staff often took the lift to a lower level to avoid families who may be waiting for news of

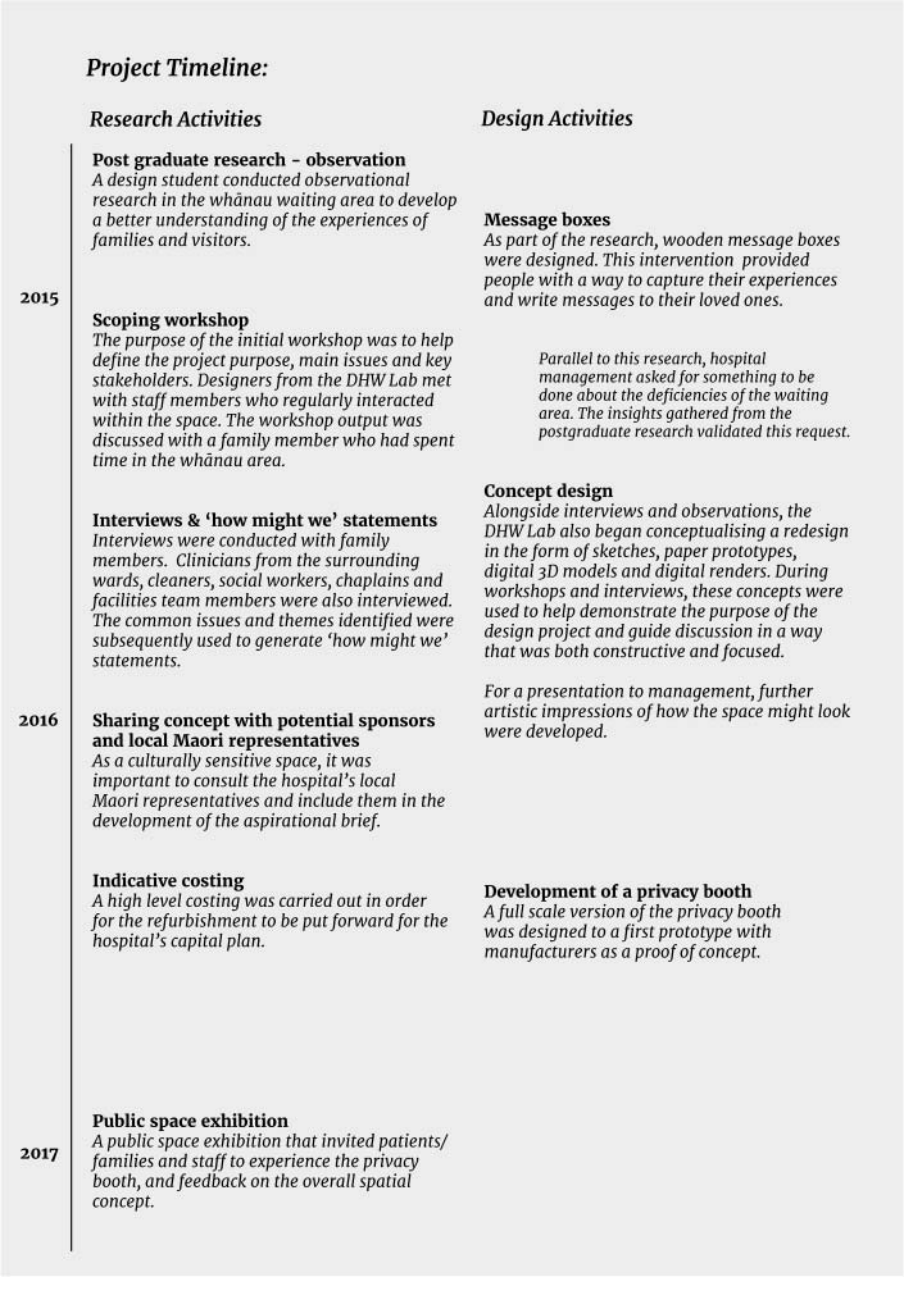

Figure 2. The project was conducted with an explorative, iterative approach, and undertaken over a two-year period.

their loved ones, and would intercept known staff members for updates. By contrast, other staff often used the area as a space to eat their lunch.

Next steps

The illustrations, sketches and models from the initial workshop were exhibited in the DHW Lab studio as provocations (visual communication of ideas and concepts), alongside a summary of findings to generate conversation and debate over the best way to refurbish the waiting area (Figure 3). In some cases, the perspectives of staff conflicted with the perceived experiences of families that used the space. For example, some staff felt that the space should be divided up into small family units or 'cabins', while families frequently shared experiences. A small amount of DHW Lab resource became available as part of a larger hospital project investigating the 'role of public space', allowing a more rigorous user engagement and prototyping process to support the development of a concept design. At this stage, the project aim was to:

> *Protect the privacy, dignity and the complex emotional needs of families present with acutely unwell whānau, whilst providing an accessible space for staff.*

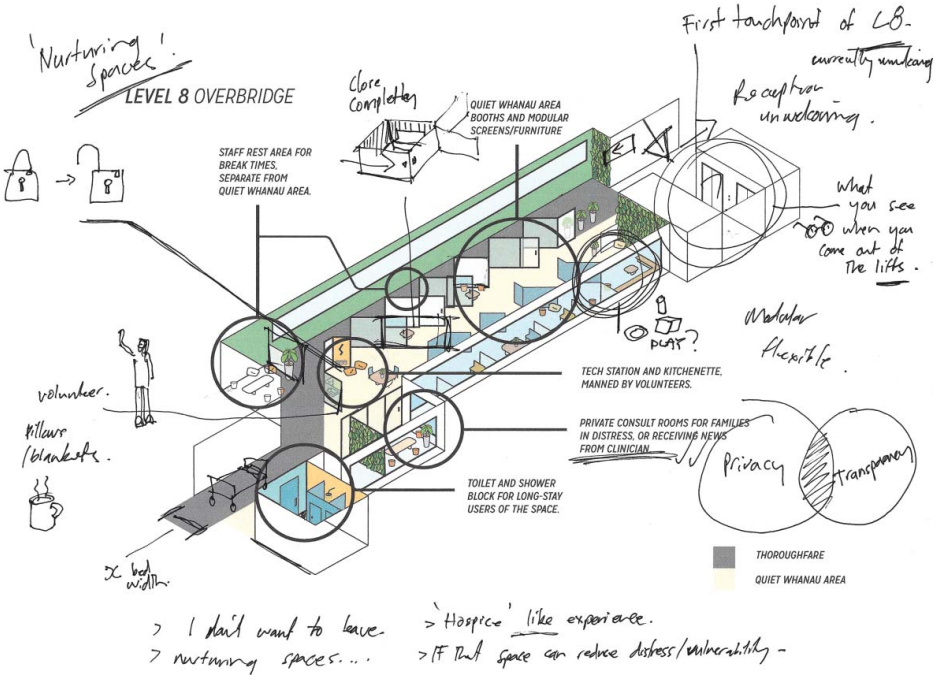

Figure 3. This illustration was an output of the scoping workshop and was exhibited in the DHW Lab. The illustration was part of a provocation intended to generate further buy-in from sponsors and management.

From early discussions to more in-depth user experiences

The user engagement process was conducted as part of an in-house hospital improvement project, and therefore subject to the hospital's protocols and policies for interviewing/observing staff and families.

Observations of group dynamics and visitor behaviour exposed the complexity of the waiting environment. Floor plans of the space were used to record user behaviour by making notes/sketches on user movement, as well as specific features of the environment at different time periods. The research also involved experience-based, face-to-face interviews with family members and staff. These were carried out by a member of the design team and a research interviewer.

During the course of this research, we met with and/or interviewed a range of clinical staff from the surrounding wards, as well as social workers, cleaning staff, Pacific health navigators, Kai Atawhai (a group dedicated to supporting the cultural and spiritual needs of Māori patients and their whānau) and a hospital chaplin. Participants (n = 23) were asked about their experiences and reflections working with families in the whānau space.

We also interviewed seven family groups (n = 11), who had spent time waiting in the whānau space, about their experiences. No families were approached while the outcome for their loved one was unknown, or if recovery was unlikely. An effort was made to speak with a range of families, including large and small groups, covering a range of ethnicities and ages. Interviewing family members was often logistically difficult as people were not reliably to be found in the same place. Notwithstanding this practical barrier, the DHW Lab team relied on the networks of a hospital project manager to connect the team with suitable participants.

The role of the designer present during the interviews was to passively interpret insights through a 'design lens' using written or sketched annotations. A 'working wall' in the DHW Lab was used to capture insightful quotes and progressively link-up creative responses to an expressed (or latent) need, and to continually update and communicate progress to stakeholders (Figure 4). This intervention was a visual link between the stories shared by families and the concepts developed by the design team. Displaying quote cards alongside ideas was imperative for helping designers to reflect on how solutions might effectively respond to user needs.

Asking open-ended questions such as 'thinking back to the first time you came into the space, what were your first impressions?' allowed participants to steer conversations toward what was important to them. We found this approach was markedly more effective than scripted questions like 'what do you think of the layout of these rooms'. As designers, we were interested in the nuances of user behaviour in the space and how people 'wished it could be'; we found that listening to patient narratives, probing beneath surface-layer details such as 'wall colour', or 'comfy couches', helped us understand their experiences

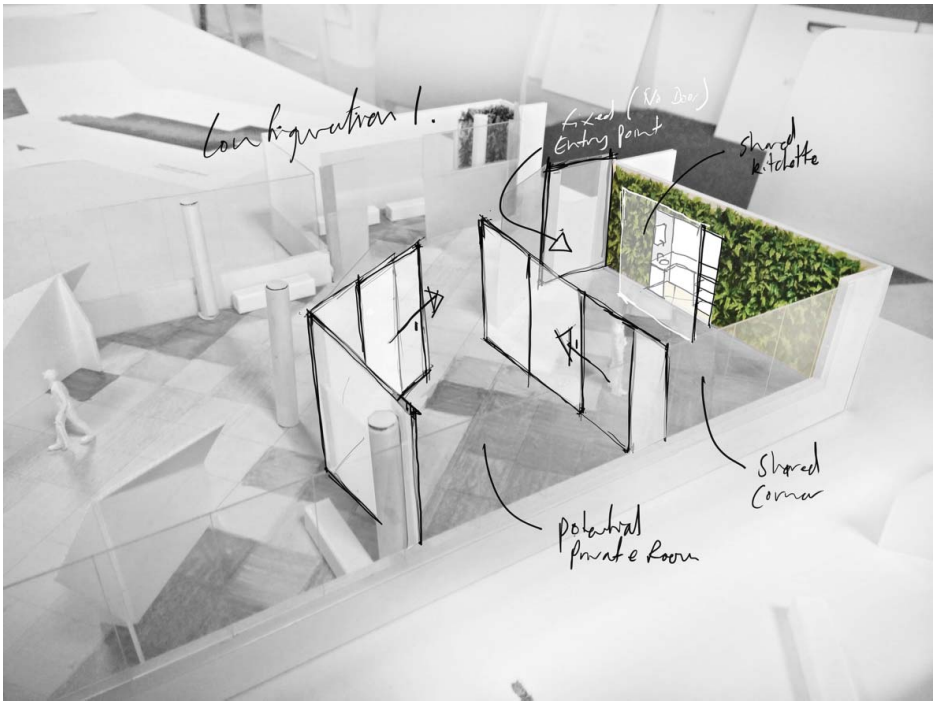

Figure 4. Examples of 'working wall' material. This mixed media image was used to show possible ways a 'homely' kitchenette function might be incorporated into the space.

of the environment. For example, by talking with nurses on the local wards, we discovered that clinical staff often avoided the area altogether, and took obscure routes around the whānau area to evade waiting family members. Communicating participant accounts of extended time spent in the environment enabled empathy from those who had not considered how the space supported the emotional needs of families.

A series of 'how might we' provocations were used to effectively communicate how designers translate rich qualitative insights gleaned from patients/staff into coherent design concepts. We shared statements such as

> *… you walk straight into other people's grief and it is hard because you want to give them privacy, but you are all right there.*
> *– Family member*

> *I don't want walls; the families build bonds between each other.*
> *– Staff*

In this instance, these insights were reframed into

How might we provide an opportunity for private conversations within a more open space?

'How might we' statements functioned as manageable design goals and helped communicate to stakeholders subsequent design responses.

They provided a degree of transparency and rigour to what can sometimes be perceived by those outside of design, as a mystifying and organic process of listening and making.

Developing creative responses

Throughout the process of observation and insight-gathering, the DHW Lab design team re-imagined the whānau space using a range of hands-on methods, including sketching, cardboard mock-ups, full-scale prototypes and digital three-dimensional models. The embedded nature of the DHW Lab allowed the project to develop over an extended duration, through periods of activity and reflection. This gave designers the time and space to produce outputs that may have never been considered or developed if the project had lived outside the hospital (Reay et al. 2017a).

Initiatives such as using a simple scale model of the environment signalled 'play' to participants, and fostered dialogue between both designers and those not trained in design around possible layout configurations (Sanders and Stappers 2008) (Figure 5). Movable components communicated that the design was not fixed, but free to be explored; this was especially effective when designers were challenged by clinicians on layout ideas, inviting them to manipulate the model as they saw fit. This simple method acted to diffuse power dynamics by deferring the discussion to the made artefact, and progressing toward an agreed concept direction. Additionally, colourless models facilitated discussion

Figure 5. Exploring flexible layouts. A scale model with movable components to explore configurations with stakeholders.

on the subject of layout and types of space – instead of fixtures and aesthetics that were out of scope for the concept design. Further, this approach was not a token 'co-design' gesture, but a strategic one. In the context of the DHW Lab, transparency was required throughout the design process in order for hospital stakeholders to buy into a solution and a methodology.

Visitors to the DHW Lab resonated with the project. They often used the space themselves (as family members) and were able to share anecdotal feedback on the insights and design concepts. Toward the end of the project, the Lab space was also used to present and discuss more resolved design ideas with decision-makers. The DHW Lab studio helped facilitate greater transparency between expert knowledge and user knowledge, helping the design process to be open to others and to aid the designers in critically reflecting on their role in the distribution of power and agency in the research process (Steen 2011).

Design outputs

A more developed and resolved concept design was presented to the senior leadership and potential philanthropic funders. The DHW Lab team looked at analogous design fields such as open-plan office partitioning – aimed at creating zones of privacy within open space. Designers were also inspired by the notion of a community park and observed parallels with the role of the whānau area; – a gathering point for people from all parts of society that could be experienced communally/socially or in private groups. The new concept layout relocated the large whānau 'rooms' so they were closer to the windows in order to capitalize

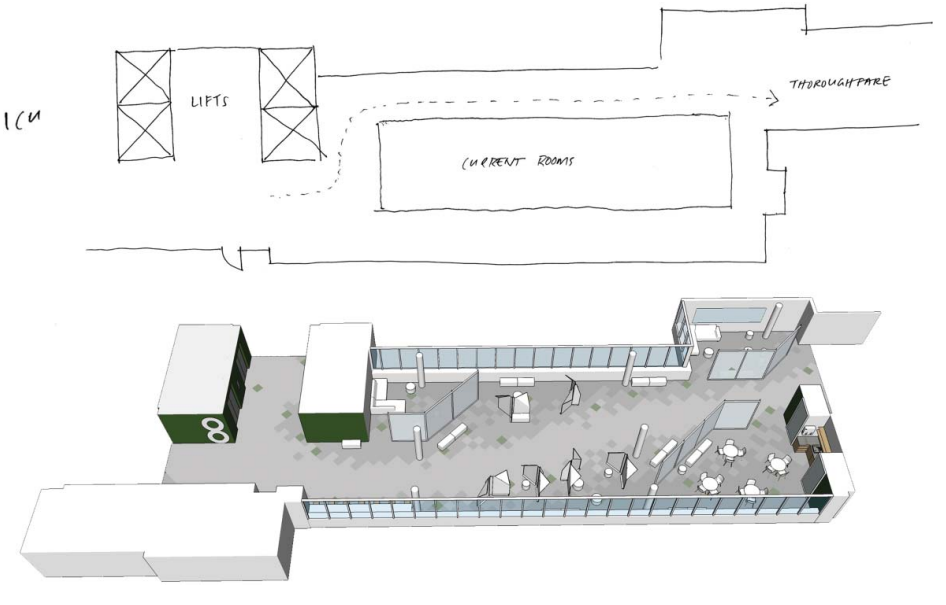

Figure 6. New layout: Three main waiting spaces are nestled into corners of the area and 'booths' make use of natural light by the windows. The line drawing depicts the existing layout.

on natural light and the calming views out to the harbour (Figure 6). The main thoroughfare was conceptually reframed as a 'stream' connecting the two buildings, with 'eddies' forming quiet zones off the main 'current'. The proposed layout creates refuge spaces for both small families and large families who might take comfort in sharing their experiences, or desire to have moments of privacy as small or large groups. The path of circulation meanders through the space, while the zones for smaller families are protected from the thoroughfare by a privacy booth concept (Figure 7). Line of sight through the space is dramatically improved, making clear to families what is actually in the space and how it might be used, while allowing staff to see who is using the area. Practical facilities, such as a lockable kitchenette and a high bench/leaner with a charging function were included as recommendations based on the repeated requests of family and friends staying for long periods.

The work was received well by the hospital management, and although not immediately funded, there was budget assigned for a quantity surveyor to indicatively cost the reimagined environment (e.g. demolition of existing rooms, the use of glass partitions, etc.) for submission to the hospital's capital plan.

The rationale for developing a booth concept was grounded in the wealth of feedback around the need for privacy while allowing users of the space to build connection with each other. The booth concept was viewed as a cost-effective way to bring dramatic change to how the environment felt and functioned. The structure was intended to be semi-permanent in its location and configuration – allowing for a degree of flexibility and experimentation in how the whānau area might function, and helping to create an area that could respond dynamically to changing needs and uses. Not only this, the physical scale of the booth was tangible to stakeholders, communicating the power of prototyping through a manageable, non-threatening intervention.

The booth prototype was the core element of a component of a '*Healing Environments*' research exhibition that explored the role of public spaces in hospitals. This opportunity doubled as a method of testing and evaluating the booth design with patients, visitors and staff (Figure 8). For the most part, the booth was left to be supervised from a distance in order to observe peoples' interactions with the object. Those showing an interest in the design were asked for their opinions on how the booth functioned and were encouraged to share how it might be improved. The design intent had been to create a moment of privacy, shielding people physically and acoustically from thoroughfares and open spaces. This was validated by feedback:

> *Such a different noise quality/perspective. It just felt very relaxing.*
> *– Visitor*

> *So calm feeling. I love that it's quieter and would feel private.*
> *– Visitor*

Figure 7. Communal area. Top: the largest of the whānau rooms incorporating a kitchenette function and a dining area for large groups who often bring food into the space. Middle: open, central thoroughfare, making the space accessible and less exclusive. Bottom: booths are used to create flexible zones of varying sizes, and allow smaller groups to feel more welcome.

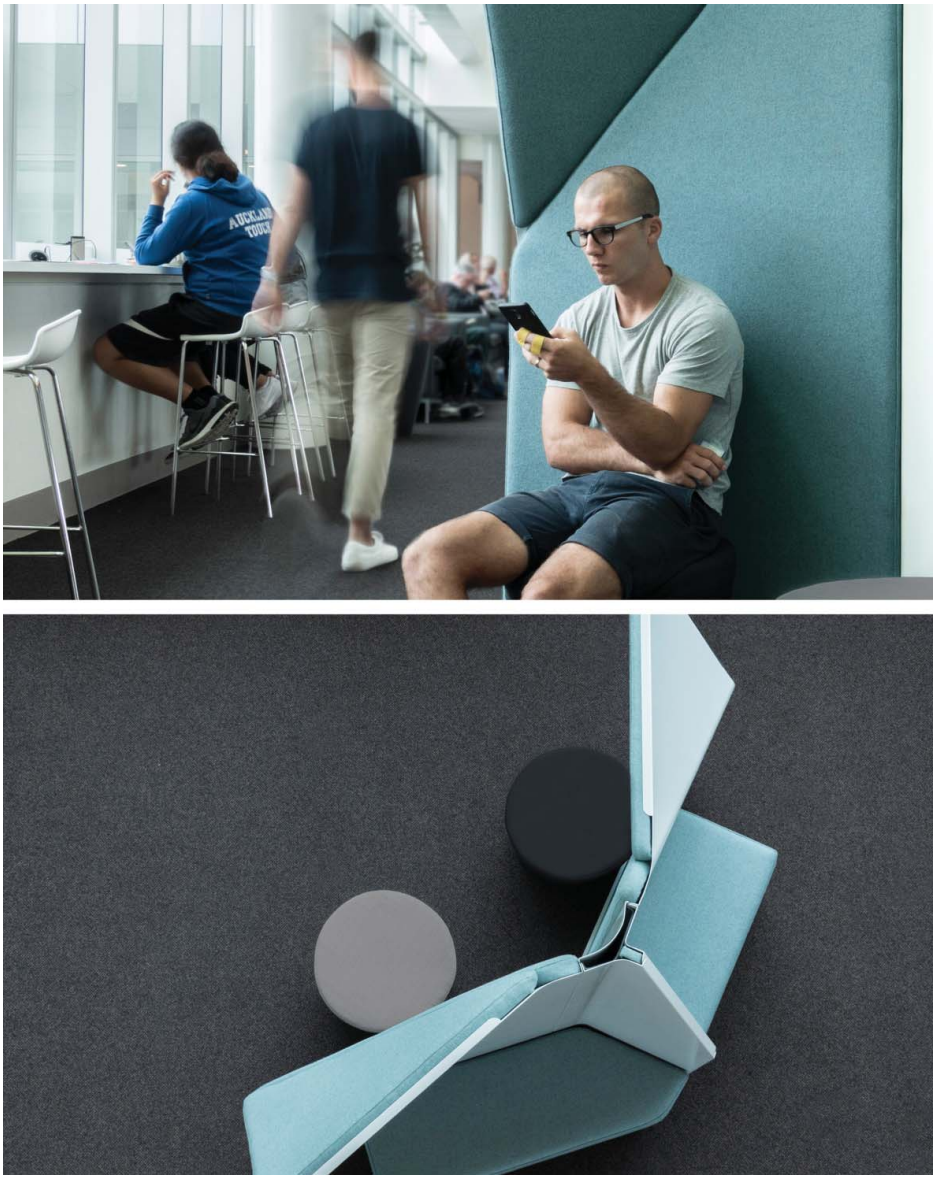

Figure 8. Public space exhibition. Booth installed at Auckland City Hospital for patients, families and staff to experience and provide feedback.

The implementation of the whānau area concept design presented in this paper currently lies with the hospital management, who are responsible for scheduling areas for refurbishment.

Discussion

This project builds on the observation by Bauer (1990), and recognized in this hospital context, that different areas of expertize often have profoundly different

methods, values, theoretical approaches, even conceptions of what counts as knowledge, and that challenges often arise not from differences in expertize but differences in culture (Reay et al. 2017b). In this project, stakeholders, families, employees and designers, despite sharing common goals for the waiting space, held different values, attitudes, beliefs and ways of thinking and doing (Bauer 1990) (Figure 9).

Design approaches taken by the DHW Lab team were underpinned by co-design as described by Sanders and Stappers (2008, 6) as 'the creativity of designers and people not trained in design working together in the design development process', by drawing in those with little experience of design and providing them with the tools to contribute to design processes (Reay et al. 2017a). The DHW Lab is still finding its feet for how it best contributes to design opportunities such as these (Reay et al. 2017a; Reay et al. 2017b), illustrated by the organic and experimental methodology of scoping and running this project. Granted, the Lab's core vision is to open up dialogue about all facets of the healthcare experience – including (in this case) the spaces affiliated to where healthcare takes place. The physical presence of the DHW Lab studio, onsite at Auckland City Hospital, encourages visitors and contributors to think and work differently (Reay et al. 2017a). Through listening and prototyping in response to opportunities – the Lab is looking for ways design can permeate throughout the experience of healthcare; both through the spectrum of projects underway and the fashion in which they are run.

In an ideal world, all those with an interest in the whānau space and what it could be would have closely worked together to realize a solution. However, this was not feasible within the scope of this project. Achieving integration and collaboration due to institutional silos is regarded as challenging in healthcare organizations (Kreindler et al. 2012; Trbovich 2014). In the case of design,

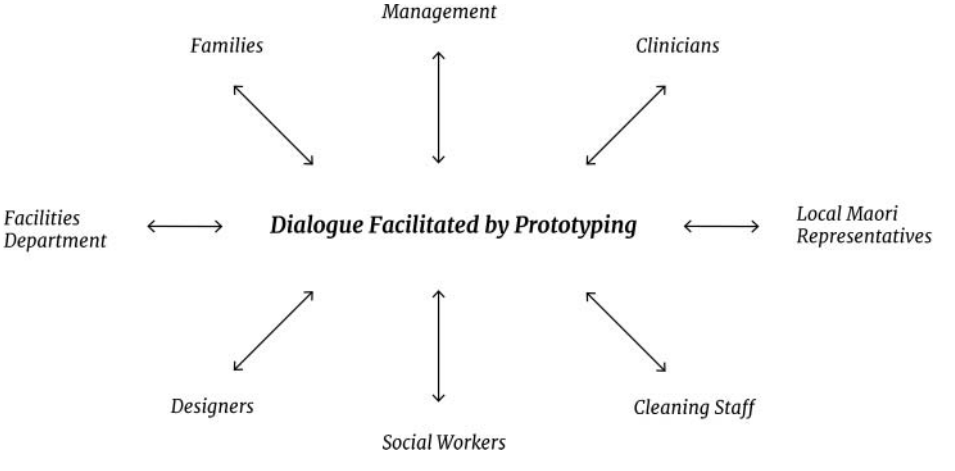

Figure 9. Facilitating design conversations. Bringing multiple stakeholders together around design artefacts to contribute to a common goal.

stakeholders often have limited or no design experience (or resource), yet often end up playing key roles in the design of new spaces. Therefore, the concept design approach made significant inroads into exploring how best to undertake these types of refurbishment opportunities – authentically listening to the complex user needs of health-seekers, their families and those who work in the hospital and using creative methods to capture insight in a feasible, practical fashion.

As it was not possible to easily bring the families to actively engage in designing together, the role of the design team was as 'active listeners' – to give visual form to the dialogue and for the prototypes to communicate this. The 'voice' (collaboration) of patients (or in this case families) is a powerful component in experience-based co-design (Donetto, Tsianakas, and Robert 2014). Successful co-design processes require staff and patients to renegotiate roles and expectations by reconfiguring the power relationships that exist between patients and healthcare services (Donetto et al. 2015). In this project, much of the role of the designer was to listen to these patient and stakeholder voices, then to give form to these voices in a way that was more easily accessible to all who were interested. In addition, the role of the 'working wall', the DHW Lab studio space, and the designers working on this project, helped the renegotiation of power as well as families and stakeholder interests and needs (Figure 10).

The DHW Lab studio is conducive to spontaneous making, with a main goal of creating believable physical objects/environments that can be experienced or understood by end users and stakeholders. The design team explored how to create intimate spaces without using fixed walls and invited stakeholders into a temporary booth structure made of card and corrugated plastic sheeting. Its purpose was to create (in low-fidelity) a physical and acoustic experience of being shielded from a large space (Figure 11). Taking people beyond the drawing board to experience what a design might be like in reality is a powerful tool that has long existed within creative fields; what is perhaps most novel in this context, is the introduction of such methods to facilities team members, potential sponsors, hospital managers, while the concept itself was still unfinished and open to being shaped. Such artefacts are a powerful way to communicate shared visions, and help to shape the future (Sanders 2013). It is through ongoing iteration and experimentation, such as this, that coalitions gather strength and are able to overcome challenges (Murray, Caulier-Grice, and Mulgan 2010).

Storytelling was used as a means of giving form to the complex needs expressed by families and staff, and thereby acknowledging that they had been heard. This project was an explorative, iterative journey that relied on the agency of made artefacts to encourage hospital buy-in and develop an authentic and practical 'user-centred' methodology with non-designers. Beginning with low-fi prototypes in response to hunches and assumptions, the project moved through to believable full-scale mock-ups, not dissimilar to a conventional design-led process. Explaining this project narrative was as important as the concept

Figure 10. A working wall at the DHW Lab. Using a living, visual record of how designers are interpreting the voice of the users.

proposal itself. The artefacts acted as provocative prototypes, helping to contribute to organizational 'sense-making' by exposing stakeholders to differing notions of patient-centredness (Boer, Donovan, and Buur 2013).

In the most literal sense, storytelling was used to help describe how the research and concept design for the whānau space responded to the needs of families and staff. Through the '*Healing Environments*' exhibition, a playful

Figure 11. Walls without walls. Exploring the possibility of a furniture scale divider that created moments of privacy in an open space.

animation acknowledged the input of staff and families into the concept design. In simple terms, the methodology of the project was unfolded and the proposed layout was explained. As discussed, the importance of transparency, and demystifying a design process for non-designers, was vital in order to create buy-in – and the potential for real, positive change.

Conclusion

In this project, the role of prototyping was used both as a critical method to give form to patient, family and staff voices in the context of the whānau area redesign, and as a methodological approach to practice. By demonstrating an alternative way of working, and changing dialogue amongst the project team, participants and management, commonly held views were more effectively able to be challenged, and people were brought together around a shared common purpose. Through this, the DHW Lab design team sought to make visible what designers do through prototyping and sharing ideas, creating collective ownership and modelling a feasible methodology for future opportunities. This process helped to demonstrate what might be expected when healthcare organizations reach beyond more traditional approaches to facility upgrades.

Note

1. Maori term for extended family or community of related families.

Acknowledgments

We would like to thank all the families and staff of Auckland DHB and designers who participated in this project; specifically, Heather Howard (Nurse Manager), Abbi Harwood-Tobin (Auckland DHB Project Manager), Justin Kennedy-Good (DHW Lab Co-director), Melanie Pau (Architectural Graduate), and Cassie Khoo and Helen Cunningham (Exhibition Designers).

Disclosure statement

No potential conflict of interest was reported by the authors.

Notes on contributors

Reid Douglas is a product designer working at the Design for Health & Wellbeing Lab. In 2013, he and his colleagues began a collaborative venture with Auckland City Hospital based on how design could be used to positively impact the experiences of patients, families and staff. The venture is now a mixed discipline design consultancy and a teaching and research platform working on a variety of design/health projects.

Stephen Reay is co-director of the Design for Health & Wellbeing Lab, a collaboration between the Auckland District Health Board and AUT, initiated to develop an intentional relationship between design process and the area of health and wellbeing, and underpinned by interdisciplinary collaboration and a strong focus on user-centred design.

Josh Munn is New Zealand-born designer with a background in industrial design currently working as a designer for Healthcare Human Factors (HHF), a design and research consultancy embedded within Toronto General Hospital. Before HHF, Josh was working for the Design for Health & Wellbeing Lab, a New Zealand-based design studio also located inside a large inner-city hospital. Josh's approach to design focuses on understanding the needs and experiences of users in their environments and working alongside them to create elegant human-centred design solutions.

Nick Hayes is a UX designer at the Design for Health & Wellbeing Lab, working on a number of projects in the mental health space. Before returning to the DHW Lab in 2016, he worked at a brand experience agency in New York, and has worked as a freelance UX designer in a commercial environment.

ORCID

Stephen Reay http://orcid.org/0000-0002-6122-6420

References

Bauer, H. H. 1990. "Barriers against Interdisciplinarity: Implications for Studies of Science, Technology, and Society (STS)." *Science, Technology, & Human Values* 15 (1): 105–119.

Boer, Laurens, Jared Donovan, and Jacob Buur. 2013. "Challenging Industry Conceptions with Provotypes." *CoDesign* 9 (2): 73–89. doi: 10.1080/15710882.2013.788193.

Donetto, S., V. Tsianakas, and G. Robert. 2014. *Using Experience-Based Co-Design (EBCD) to Improve the Quality of Healthcare: Mapping Where We are Now and Establishing Future Directions*. London: Kings College London.

Donetto, Sara, Paola Pierri, Vicki Tsianakas, and Glenn Robert. 2015. "Experience-Based Co-Design and Healthcare Improvement: Realizing Participatory Design in the Public Sector." *The Design Journal* 18 (2): 227–248. doi: 10.2752/175630615x14212498964312.

Keene, L., P. Bagshaw, M. G. Nicholls, B. Rosenberg, C. M. Frampton, and I. Powell. 2016. "Funding New Zealand's Public Healthcare System: Time for an Honest Appraisal and Public Debate." *New Zealand Medical Journal* 129 (1435): 10–20.

Kreindler, S. A., D. A. Down, N. D. Star, and T. Gottschalk. 2012. "Silos and Social Identity: The Social Identity Approach as a Framework for Understanding and Overcoming Divisions in Health Care." *The Milbank Quarterly* 90 (2): 347–374.

Murray, R., J. Caulier-Grice, and G. Mulgan. 2010. *The Open Book of Social Innovation*. London: National Endowment for Science, Technology and the Art.

Reay, Stephen, Guy Collier, Justin Kennedy-Good, Andrew Old, Reid Douglas, and Amanda Bill. 2017a. "Designing the Future of Healthcare Together: Prototyping a Hospital Co-Design Space." *CoDesign* 13 (4): 227–244. doi: 10.1080/15710882.2016.1160127.

Reay, Stephen D., Guy Collier, Reid Douglas, Nick Hayes, Ivana Nakarada-Kordic, Anil Nair, and Justin Kennedy-Good. 2017b. "Prototyping Collaborative Relationships between Design and Healthcare Experts: Mapping the Patient Journey." *Design for Health* 1 (1): 65–79. doi: 10.1080/24735132.2017.1294845.

Sanders, E. B.-N. 2013. "Perspectives on Participation in Design." In *Wer Gestaltet die Gestaltung?: Praxis, Theorie und Geschichte des Partizipatorischen Designs*, edited by C. Mareis, 61–75. Bielefeld: Transcript-Verlag.

Sanders, Elizabeth B. N., and Pieter Jan Stappers. 2008. "Co-Creation and the New Landscapes of Design." *CoDesign* 4 (1): 5–18. doi: 10.1080/15710880701875068.

Steen, Marc. 2011. "Tensions in Human-Centred Design." *CoDesign* 7 (1): 45–60. doi: 10.1080/15710882.2011.563314.

Trbovich, P. 2014. "Five Ways to Incorporate Systems Thinking into Healthcare Organisations." *Biomedical Instrumentation & Technology* 48: 31–36. doi: 10.2345/0899-8205-48.s2.31.